All-ceramic restorations with IPS e.max

Minimally invasive methods to achieve harmony between pink and white aesthetics

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Minimally invasive restorations have long become a reality owing to the improvements in bonding materials and the enhanced strength of ceramic restoratives. However, a solid understanding of the materials’ properties and clinical steps is essential to be able to benefit from these advances. We believe that ineffective all-ceramic restorations can largely be attributed to human error caused by a lack of familiarity with the materials, as well as incorrect tooth preparation or bonding procedures. Five case studies will be presented in this article to demonstrate the flow of treatment from initial examination and diagnosis to final cementation.

In the first case, the patient’s teeth were badly stained (Fig. 1). Even after repeated whitening, the appearance was still not satisfactory. The patient finally presented to the practice with the wish to have his teeth restored with veneers.

A few years ago, all-ceramic crowns on metal or zirconia frameworks would have been the method of choice to treat such severely discoloured teeth. Now, we favour a minimally invasive approach with lithium disilicate (LS2; IPS e.max Press, Ivoclar Vivadent). Given its high strength (400 MPa), this material is even suitable for veneers with a layer thickness of as little as 0.3 mm (Fig. 2). From a wide range of shades and different levels of translucency and opacity, users can select the ideal ingot for every patient situation. Other convincing features include high accuracy of fit and excellent aesthetics.

Harmony and beauty are inherent in natural teeth. As dentists, we must reproduce this effect with artificial materials. IPS e.max Press has enabled us to emulate the nuanced colour effects of natural teeth. The patient’s state of oral health is first assessed and the information gathered in the process forms the basis for the subsequent treatment planning. The key to success is to involve the dental laboratory at this stage already and to share the information gathered in the assessment process with the technician.

In addition to taking the usual oral and facial images, radiographs and impressions, we perform cephalometric analyses and jaw function tests, depending on the indication. In addition, we evaluate the aesthetic characteristics. By consulting the treatment partners, we seek to gather as much information as possible with the aim of using this data to prepare a treatment plan in which we consider not only the tooth to be restored, but also the overall balance between the facial configuration and oral cavity.

Staining technique vs cut-back technique

Although the staining technique has a favourable effect on strength, it places limits on the aesthetic design of the restoration. Wherever we treat patients who require restorations in the anterior region, we prefer to use the refractory die method (IPS e.max Ceram, Ivoclar Vivadent) or the cut-back technique (IPS e.max Press). In the posterior region, however, we often opt for the staining technique. The result of a study conducted at New York University demonstrates the high strength of monolithic LS2 restorations manufactured in conjunction with the staining technique. Against such a background, we only occasionally use the layering or cut-back technique for full-crown restorations and often choose to design the occlusal surface with IPS e.max Press owing to its high strength (Figs 3 & 4).

Preparation

Minimising invasiveness is one of the goals of aesthetic dentistry. While the work of the dental technician may be supported by removing large amounts of tooth structure, this cannot be an acceptable reason for an unnecessarily high level of invasiveness. However, if a tooth has been prepared insufficiently, the technician may find it difficult to achieve an aesthetically satisfactory restoration in the correct shade.

Veneer restorations are incorporated by bonding the restoration material to the tooth structure using an adhesive technique. Although the materials for adhesive bonding have been improved to enhance the bond strength to dentine, the preparation borders should nonetheless be limited to the enamel to attain reliable adhesion. Generally, the shape of the preparation is designed in such a way that it takes both aesthetic and biomechanical aspects into account. For this purpose, a silicone key may be created on the basis of the diagnostic wax-up.

Indexing the tooth horizontally into three areas (cervical, coronal and incisal) allows the amount of tooth structure being removed during preparation to be checked. Additionally, a guide in the shape of the final tooth preparation may be used as a reference in complex micro-veneer preparations.

The preparation is performed under a microscope, resulting in clearly defined margins, thereby facilitating the work of the technician and enhancing the accuracy of fit.

Shade selection

Aesthetic restorations of discoloured teeth usually require the removal of larger amounts of tooth structure than usual. With the introduction of LS2, however, we have been able to achieve shade adjustments with minimal reduction of tooth structure. For this, communicating the colour of the tooth preparation to the technician is essential. Photographs, shade tabs and digital shade-measuring devices are examples of instruments that can be used for shade communication. While shade-measuring devices are suitable for objective shade evaluations, they only provide information on a limited gamut of colours. They cannot convey subtle nuances. Photographs of the teeth with the shade tabs placed next to them are better suited to this purpose. Using tooth-coloured IPS Natural Die Material (Ivoclar Vivadent) is particularly useful for the fabrication of veneers on discoloured teeth.

Transparency—the key to aesthetic restorations

When restoring discoloured teeth, we tend to select an ingot with high opacity. However, using an opaque ingot entails the risk of obtaining...
a “white” restoration that appears too bright.

Veneers should be of a similar translucency to the natural teeth. In the case of severe discoloration, an appropriate translucency can be achieved by selecting an ingot in a translucent bleach shade. A masking effect is then achieved with the base material, that is, framework, of a thickness capable of blocking out the severely discoloured areas, while the shade of the restoration is reproduced with the veneering ceramic (IPS e.max Ceram). This approach allows the technician to achieve a sufficiently powerful masking effect while maintaining the translucency of the restoration.

Accuracy of fit is one of the success factors for an aesthetic restoration. Since we started using IPS e.max Press, we have been able to try in the framework. This is not possible with veneers fabricated using the refractory die method. At the try-in, the shape, shade and marginal fit are checked. White wax is used to contour the planned tooth shape on the framework and then the restoration is inserted in the patient’s mouth for a try-in. Adjustments, such as modification of the crown length and shape, can now be applied.

Veneers may be tried in with try-in pastes. However, we use water for this purpose because it has a better fluidity. After a drop of water has been applied to the inside surface of the veneer, the veneer is placed on the tooth preparation (Fig. 5). This requires a meticulous working method under the microscope. At first, a white line appears between the preparation margin and the framework. If the marginal fit is accurate, the water penetrates and the line disappears.

Shade adjustment by layering

If several adjacent teeth had to be restored for different indications in the past, the restoration, allowing for little variation in shade, had to be fabricated first (e.g., veneers first and then crowns fabricated to match the shade of the veneers). Given its excellent light-scattering properties, IPS e.max Press allows users to fabricate all restorations simultaneously (Figs. 6–7).

We try not to change the shade of the ingot even when working with several tooth preparations showing inconsistent shades. A minute change in thickness is all that is required to control the base shade. In this way, shade interpretation can be simplified for shade adaptation by layering. One of the characteristics of the IPS e.max LS, ceramic is that it maintains its translucency.

If all of the teeth were reduced by the same amount of tooth structure, it would remain challenging to match the shade of the restorations that require varying build-up layer thicknesses. If the thickness of the framework has been maintained to match the shade by means of the framework, the amount of layering ceramic must be reduced accordingly. In this case, the luminosity of the dentine may be increased by using bleaching shades, and saturation may be intensified by internal staining. This method is often applied in adjacent teeth where one is vital and the other is non-vital.

Often, preparations with varying amounts of removed tooth structure also show inconsistent layering thicknesses. As a result, shade matching becomes more difficult. Since IPS e.max Press is available in several levels of brightness, translucency and intensity, a satisfactory result can be achieved in such challenging situations by selecting an appropriate ingot and combining it with IPS e.max Ceram.

Cementation

Adhesive bonding is essential to minimally invasive dentistry. In veneers in particular, adhesion by bonding plays a more important role than does mechanical retention. If a veneer fails, it is often because a faulty bonding procedure has been applied.

Placing the temporary

Atemporary restoration is not simply a short-term tooth replacement. It is a therapeutic step that requires full attention. We use a transparent luting composite (Telio CS Link, Ivoclar Vivadent) for the placement of temporaries. First, small spots of the prepared surface are etched using the spot-etching technique (Fig. 8) and then a touch of bonding composite is applied to attach the temporary restoration (Fig. 9).

Pretreating the tooth surface in preparation for final cementation

Since semi-translucent luting composite is difficult to detect, caution should be taken to ensure that no residue is left on the tooth prior to final cementation (Fig. 10). Working under a microscope is recommended.

The tooth is cleaned thoroughly to create a clean environment. Fluoride-free and peroxide-free cleaning procedures using a soft brush are suitable for this step (Fig. 11).

Cementing the final restorations

For the cementation of the veneers, we use the light-curing Varo-link Veneer composite (Ivoclar Vivadent), which exhibits a high degree of shade stability. The sequence of steps is as follows: placement of retraction cord, cleaning of the inner restoration surface with Ivoclean (Ivoclar Vivadent), silanation and finally cementation. A rubber dam is applied to create a dry environment for the application of the bonding material. Adjacent teeth are separated with strips. The restorations can now be seated (Fig. 12).

It is important to use Liquid Strip (Ivoclar Vivadent) to prevent the formation of an oxygen-inhibited layer.

Discussion

IPS e.max Press LS, glass-ceramic is compatible with minimally invasive procedures. Until recently, aesthetic dentistry was associated with the reduction of healthy tooth structure. However, we would like to reverse this unfavourable image by pointing out that IPS e.max is a material that allows for minimally invasive methods to achieve aesthetic restorations.

Reference

1. Guesa et al. 2010